Composite guidance scaffolds for neural tissue engineering

Conference or Workshop Item

Composite guidance scaffolds for neural tissue engineering

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Development of a tissue engineering conduit for the surgical repair of peripheral nerves has led to the investigation of various composite devices. In particular, fibronectin and collagen are versatile endogenous proteins which can be used for this purpose. Here we report an implantable device that will deliver a tethered aligned collagen guidance conduit containing Schwann cells into a peripheral nerve injury site. Cells (Schwann cells and fibroblasts) incorporated into tethered rectangular collagen gels contracted and resulted in uniaxial alignment. This tissue engineered construct was tested in 3D culture and demonstrated the ability to guide neurite extension from dissociated dorsal root ganglia. A silicone tube was adapted to provide tethering sites for an implantable construct such that uniaxial cell-generated tension resulted in the formation of a bridge of aligned collagen fibrils, with a resident Schwann cell population. The potential of this device for surgical nerve regeneration was assessed in a 5 mm defect in a rat sciatic nerve model. Neural regeneration through this device was significantly greater than controls, demonstrating that this system has potential both as a simple robust clinical implant and as a 3D engineered tissue model. Further developments are underway to develop composite materials which incorporate both collagen and fibronectin and to replace the silicone element with a bioresorbable material.